Resolution effects for neutron diffraction on PZN/PMN

The use of Ge perfect crystal analyzer (mosaic of 1') gives very good Bragg resolution with reasonable intensity when the d-spacing of the analyzer matches that of the diffraction being measured (note that $a^* \approx 1.54$ Å for PZN/PMN).

Here we compare the Longitudinal Bragg widths for different instrument setups (collimations, analyzers) and sample conditions (mosaic). We plot resolution FWHM/Q vs Q in Fig. 1 to Fig. 3, since FWHM/Q is directly related to the detectability of lattice distortions and Bragg width broadenings. In Fig. 4 we show the Bragg resolution in the (hk0) plane around the (220) Bragg peak of different configurations with reciprocal lattice units (multiples of a^*). Fig. 5 is an example of this new technique: PMN-20PT (220) Bragg peak mearured with Ge(004) perfect crystal analyzer by Peter Gehring. The mosaic for the PG(002) analyzer is about 35'.

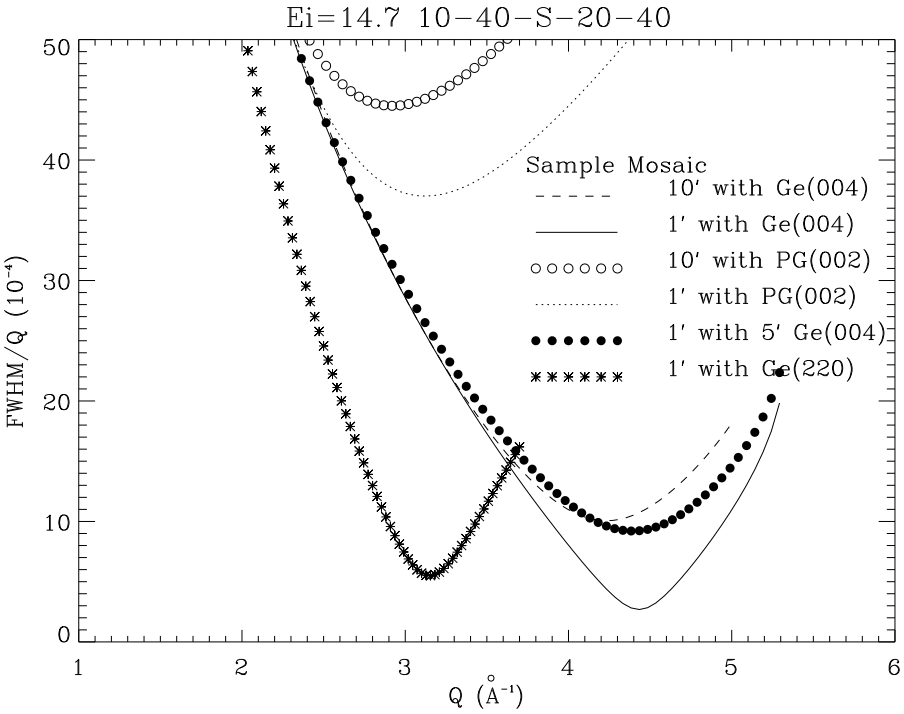

FIG. 1: Bragg resolution for different analyzer crystals and/or different sample mosaic with the collimations we usually use (10'-40'-S-20'-40').

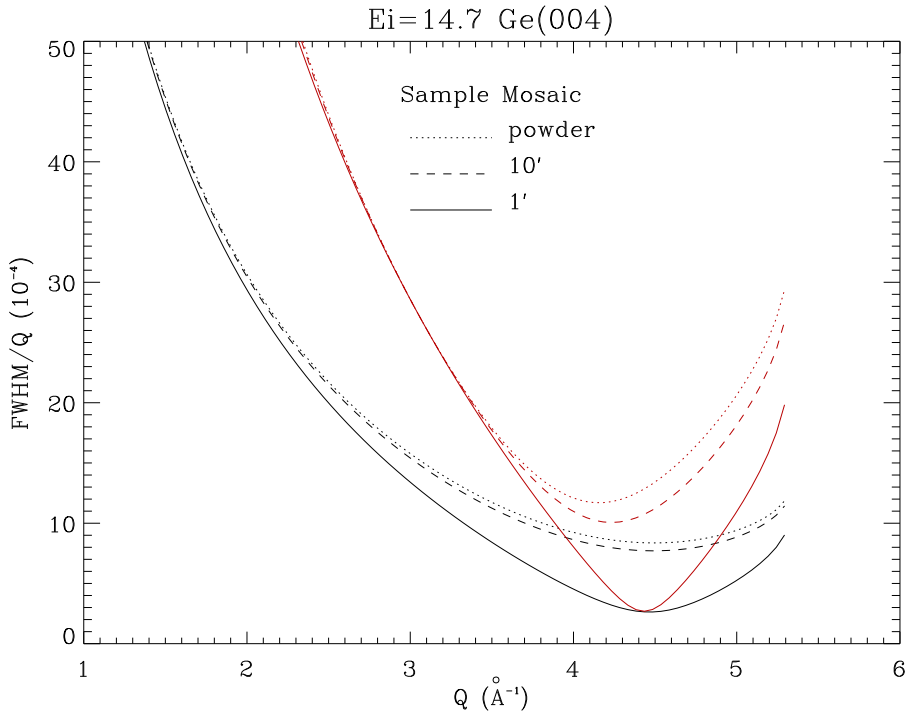

FIG. 2: Plot of the Bragg resolution with Ge(004) perfect crystal analyzer. Collimations are 10'-10'-S-10'-10' for the black lines and 10'-40'-S-20'-40' for the red lines.

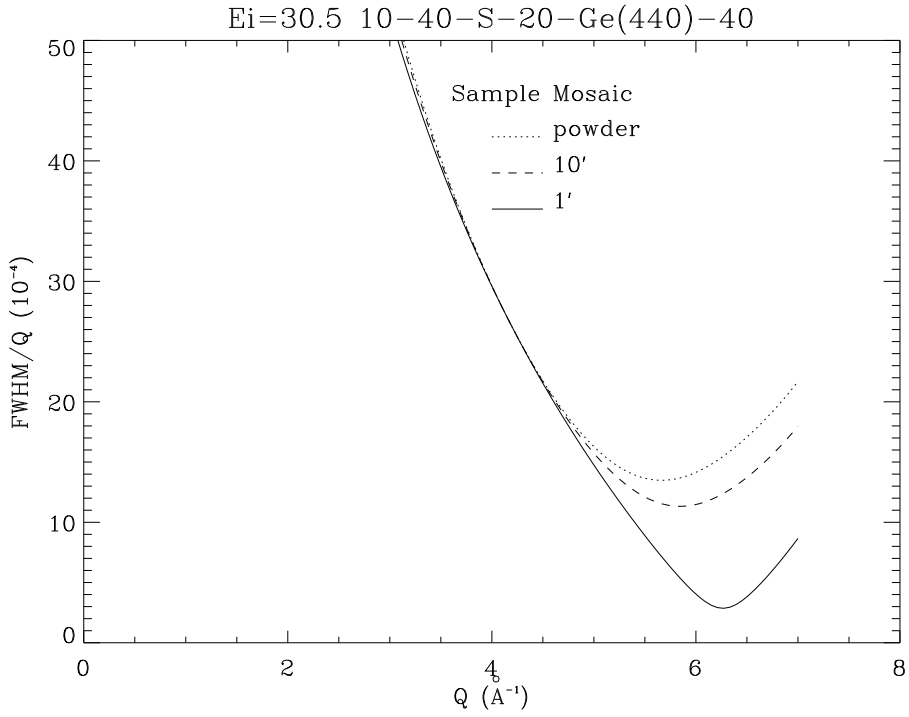

FIG. 3: Plot of the Bragg resolution with Ge(440) perfect crystal analyzer and E_i of 30.5 meV.

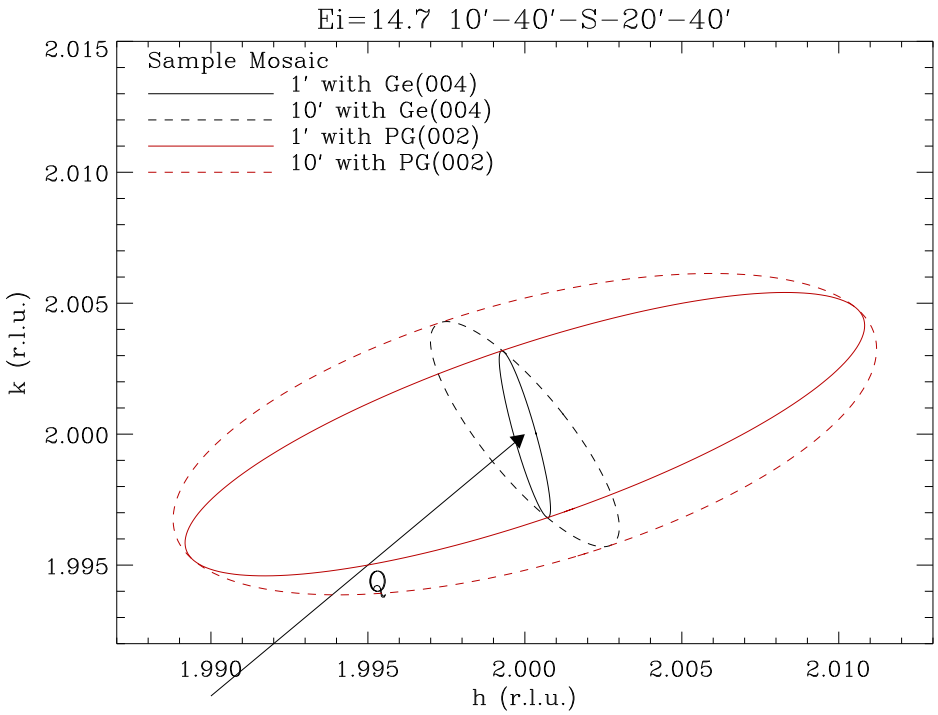

FIG. 4: Bragg resolution in the (hk0) plane around the (220) Bragg peak with different configurations.

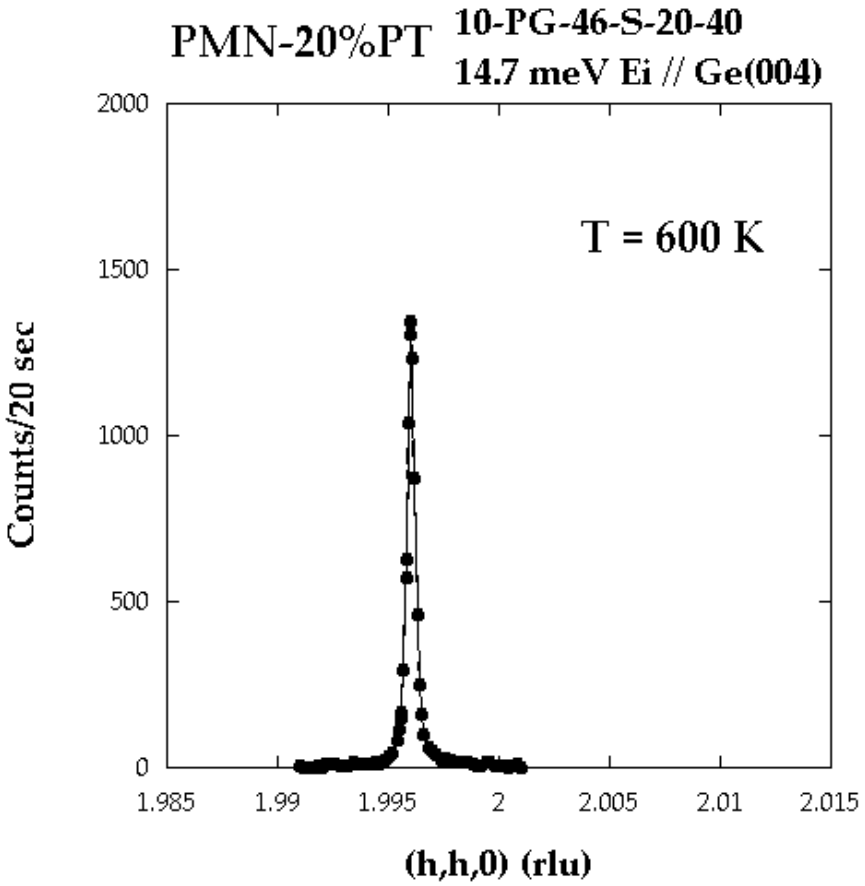

FIG. 5: PMN-20PT, (220) Bragg peak measured at BT9 with Ge004 perfect crystal analyzer. Measured by Petar Gehring.